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storm rising; but now, on the contrary, it rejoiced me. I felt God, so to speak, at the first appearance of a thunder-storm; and used to take the opportunity, at such times, to fix myself in order to view the clouds, and see the lightning play, and hear the majestic and awful voice of God's thunder, which oftentimes was exceedingly entertaining, leading me to sweet contemplations of my sweet and glorious God."

We find a new meaning in the Connecticut valley and the Berkshire hills, if we think of them as the setting of such pure rapture and aspiration, the very echo of Assisi. If there be much more of equal value in the writings of Jonathan Edwards, Dr. Riley would render a valuable service to his countrymen by editing a volume of selections from the New England saint, which would become a valued possession for all who believe in the American spirit.

CHARLES JOHNSTON.

ARRHENIUS ON "WORLDS IN THE MAKING."*

ABOUT fifty years ago, the greatest minds were engaged upon an intricate and baffling problem. What becomes of the vast outpour of energy, of heat and light, from the monstrous surface of the sun? Some is intercepted by the little globule of iron that we call the earth; and to this, we know, every trace of life and movement on this globule is due; the rush of the winds, the waterfall, the growth of the plant, every thrill of pain or joy, every idea, we experience is but the mechanical translation of the energy of the sun.

But the amount of this energy intercepted by the planets is infinitely slight—not a billionth. Whither all the rest?

Fifty years ago experimental science had reached an experimental demonstration of a truth, or idea, long entertained by some ancient philosophers: that nothing can come from nothing, that whatever is was, from aye, and will be, for aye; that there is no creation, no destruction, no creator, no destroyer. This thought was summed up in the modern doctrine of the Conservation of Energy: in Spencer's simpler and more vivid phrase, the Persistence of Force.

But if the suns, and all other bodies, be constantly radiating into space the stores of heat-energy they contain, the available,

* "Worlds in the Making." By Svante Arrhenius. New York: Harper & Brothers.

utilizable fund seemed constantly on the decrease. We had the familiar picture of a universe that, clocklike, is running down.

New supplies of light and heat might be transiently liberated by the collision of suns with suns, such as we now know to be constantly taking place; but this would, to us, merely delay the unescapable event.

So reasoned the strabismic—chief among them the late Lord Kelvin. But to the larger and clearer vision of Spencer—seer, in the highest sense, if there ever was one—came the perception that matter and motion being indestructible, there could be no such finality. Already, in the first edition of First Principles (1860), he had announced this view, and in a later edition it was considerably developed.

This conception of an unending cycle, with no beginning and no end, is the key-note of the remarkable volume which has recently come from the pen of Professor Svante Arrhenius, of Stockholm, which now finds its way into English.

Like all vast conceptions, it is simple in the last degree. It comes from one of the most varied and brilliantly endowed minds of our generation—a Helmholtz of our time. Arrhenius was already practically the founder of one new science, physical chemistry, and a foremost worker in at least two others. His Textbook of Cosmical Physics, a monumental work, stamped his authority in the field covered by this slender but fascinating volume. He has revealed that, now as always, the great mind has right of eminent domain, and that the specializer is a grubber merely.

In a volume simply teeming with new ideas and ingenious explanations, it is difficult to make selection. Aside from the demonstration that the second law of thermodynamics cannot be universally true, perhaps the most interesting portion of the book is that which brings low another pet theory of Kelvin's—of Helmholtz as well—that the sun is not many million years old — perhaps less than forty, and can last but a few million more, as a sun.

Not in contraction of its mass, but in the liberation of the stores of heat absorbed in the nebular state, does Arrhenius find the origin of the sun's energy. It is chemical rather than mechanical, and may be thousands of times greater than the older speculators had supposed. This new view naturally sets no bounds to the geologists' claims as to the immense antiquity of the earth. What Huxley said, in his celebrated strife with Kelvin (whose notions, at base, were always perverted by a curious theological twist) must be true, Arrhenius offers as a fact.

It was Arrhenius, as is well known, who was the first to apply the newly discovered *pressure of light* (and all radiant energy) to cosmical problems and thus elucidate the mysteries of the northern lights, the aurora, the zodiacal light and a score of others. It is these same particles, shot off by the sun, which doubtless, together with the varying intensity of the sun's radiation, determine our weather changes, and hence, indirectly, the course of our fitful little lives.

The desirability of other planets as abodes of the blest and others, is interestingly discussed in the light of other data than that dispensed from Flagstaff, Arizona; and finally, this interesting man gives a sketch, in the final chapter, of his novel theory of the transmission of life from world to world. This he conceives is accomplished by means of minute spores, which are driven out of a planet's atmosphere under this same pressure of light, and so in time come to fertilize those which are sterile, and thus make possible such a wondrous development as modern science has revealed to our astonished and purblind eyes. Arrhenius holds that just as matter and energy are eternal, so possibly life is; and just as the matter of the universe is known to be all the same, so also may be its living shapes.

This throwing back of the life problem to the region of primal things is carefully worked out, and though I, for one, cannot believe it is forced by our present knowledge, or lack of it, there are no especial objections to such a view, save in that it will probably be taken to give a new lease of life to the Obscurantists—the people who want to make a mystery of everything. The last of these Intransigeants are now dangling from the broken end of a dead limb, over an abyss that will soon swallow them utterly; it will comfort them to find so strong a thinker, as it were, passing them a rope. The synthesis of living substance within thirty or forty years will, I believe, forever dispel the notion that life is any more of a mystery than water, stones or air, save in the complexity of its organization of matter. Forever will the great world-mystery abide; all else, all it contains, is explicable, and will one day be explained.

CARL SNYDER.